REVIEW OF THE 2001 INVESTIGATION AND CLEANUP OF THE MIDWAY VILLAGE RESIDENTIAL COMPLEX IN DALY CITY, CALIFORNIA

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Executive Summary

The Midway Village housing complex in Daly City is comprised of 35 multi-family townhouse style buildings on approximately 18 acres. The land upon which the housing is built is contaminated with chemical residues from a former manufactured gas plant that operated in the early 1900s. Investigation and cleanup of contamination at the complex was conducted by the Department of Toxic Substances Control (DTSC), the agency within the California Environmental Protection Agency (Cal/EPA) that oversees remediation of hazardous wastes. This work was initiated in 1990 and was completed in May 2003.

In response to ongoing community concerns about the remediation, the Cal/EPA Interagency Working Group on Environmental Justice met on October 25, 2005 to discuss the history of the Midway Village investigation, the procedures adopted to remediate the contamination, and the steps taken to address the health concerns of the residents.

Dr. Alan Lloyd, the Secretary of Cal/EPA, then requested that the Office of Environmental Health Hazard Assessment (OEHHA) conduct an evaluation to examine whether the remedial actions were adequate to fully protect the health of residents living at the Midway Village complex. This task was carried out by the Integrated Risk Assessment Branch of OEHHA. The 2001-02 removal action was a particular focus of this review. Evaluation criteria were the application of sound science, consistency with the current practice of human health risk assessment, and concordance with state and federal guidelines for management of health risks at properties contaminated with hazardous chemicals.

The Working Group also wanted to invite members of the Cal/EPA Environmental Justice Advisory Committee (CEJAC) and the community to participate in this review and evaluation process. A committee of three members of the CEJAC, a community consultant and a toxicologist from DTSC was assembled to critically review, provide comment and supplement the evaluation report.

OEHHA reviewed more than 30 reports and background documents dealing with contamination at Midway Village. Based on this information, we conclude that the nature and extent of contaminants in surface soil have been adequately characterized for the purpose of assessing potential risks to human health. While contaminants still remain in subsurface soil, minimal opportunities for exposure to these contaminants exist. The remedial actions taken by DTSC, together with ongoing institutional controls on land use, are sufficient to prevent significant exposure to contaminants in surface and sub-surface soil. Since potential pathways for exposure have been blocked or are insignificant, potential health risks are insignificant as well. The remedial actions taken at Midway Village appear to be consistent with federal and state guidelines for management of health risks at hazardous waste sites.

Background

This draft report summarizes the results and conclusions of OEHHA's review of the investigation and remediation of contamination at the Midway Village Housing Complex. The review was conducted at the request of the California Environmental Protection Agency's Interagency Working Group on Environmental Justice. The review was conducted by Dr. Charles Salocks, OEHHA Staff Toxicologist, over a period from December 21, 2005 through January 25, 2006.

Scope of Review

OEHHA was asked to review available reports and documents describing the 2001-02 investigation and cleanup of contamination at the Midway Village Housing Complex in Daily City, California. As stated in a December 13, 2005 letter to members of the Midway Village Review Committee, the primary objective of OEHHA's review was "…to determine if the scientific process used in the evaluation and cleanup was protective of the health of local residents." Accordingly, OEHHA reviewed more than thirty documents, dating from 1990 through 2005, that describe the analysis of soil, air and groundwater samples collected the site; the qualitative and statistical evaluation of the resulting data; the assessment of potential adverse effects on human health; and the effectiveness of the remedial strategies that were chosen to mitigate the risks to residents of the complex. A bibliography of the documents that were reviewed is attached to this report.

Site Description and History of Previous Investigations

The Midway-Bayshore site consists of the Midway Village housing complex, Bayshore Park, and the Bayshore Childcare Center. The housing complex, consisting of 150-units of residential housing units in 35 townhouse-style buildings, occupies approximately 13.8 acres of land (Ecology and Environment, 1993; p. 2-1). Bayshore Park, which occupies the northeast portion of the property, is a 3.8-acre recreational facility that includes a baseball diamond. The daycare center is located near the center of the 17.6-acre land parcel, between the housing complex and the Bayshore Park.

The land on which the complex stands is immediately adjacent to a former manufactured gas plant (MGP) that produced light gas components from the heavier oil. The plant operated from 1905 to 1916. In addition to producing gas for residential, commercial and industrial use, operations at the plant generated tars and lampblack, which contain a class of chemical compounds collectively referred to as polycyclic aromatic hydrocarbons (PAHs)[1]. As part of construction of Navy housing in the mid-1940's, soil contaminated with PAHs was removed from the former MGP property and used for grading. In 1976-77, the Navy housing was demolished and the Midway Village complex was constructed.

[1] PAHs are also referred to as Polynuclear Aromatic (PNA) compounds. PAH is currently the preferred term for this class of compounds.

As a consequence, significant portions of the Midway Village complex were constructed on land contaminated with PAHs.

A detailed history of previous investigations and remedial actions taken at the complex, excerpted from September 2002 *Removal Action Completion Report* prepared by Engineering/Remediation Resources Group, Inc. (ERRG) is attached to his report. A subsequent investigation of PAHs in indoor air was completed after ERRG's historical review was completed. The results of that study and an evaluation of the potential cancer risks associated with inhalation of naphthalene indoors are discussed separately below.

Scope of Previous Investigations

Adequacy of Site Characterization
Over the past 15 years, hundreds of soil, ground water and air samples have been collected at Midway Village and Bayshore Park, and analyzed for a variety of potential contaminants. The design and results of each investigation are described briefly below.

- **Soil Sample Data Report (CH2M Hill, 1990)**. In September and December 1989, a total of 34 soil samples were collected: five discrete surface samples, 28 composite surface samples, and one hand auger sample from a depth of two feet below ground surface (bgs). All samples were analyzed for individual PAHs using U.S. EPA Method 8310. Discrete samples and the single hand auger samples were also analyzed for total cyanide using U.S. EPA Method 9010. The hand auger sample was the only one analyzed for volatile organic compounds (VOCs). All samples were collected from the northern half of Midway Village. PAHs were detected in all but one sample; the maximum detected *total* PAH concentration was 107.6 mg/kg. Cyanide compounds were detected in all five discrete samples and the hand auger sample; the maximum detected concentration was 3.1 mg/kg. VOCs were not detected in the single hand auger sample.

- **Soil Sampling Report (Applied Consultants, 1990)**. In mid-August of 1990, an investigation was conducted on behalf of the San Mateo Housing Authority to determine the appropriate disposal of soil excavated during trenching for a drainage system. Two composite samples were collected from soil piles and three composite samples were collected from the trench walls. Two weeks later, nine additional discrete samples were collected from soil piles and trench walls. Samples were collected from both the northern and southern portions of Midway Village. All sample were analyzed for individual PAHs using U.S. EPA Method 8270. PAHs were detected in ten of the fourteen samples collected. The maximum detected *total* PAH concentration was 109.6 mg/kg.

- **Remedial Investigation Report (Ecology and Environment, 1993)**. Between September 1992 and March 1993, 70 discrete surface samples were collected from the upper two inches of soil and analyzed for individual PAHs by U.S. EPA Method 8310, total cyanides (i.e., the sum of soluble cyanide salts and some insoluble cyanide complexes) by U.S. EPA Method 9010, and total phenols (i.e., the sum of all

compounds containing a phenolic moiety) by U.S.EPA Method 9065[2]. Wherever possible, surface samples were collected from apparent high-use areas where bare ground was visible. In addition, 80 discrete subsurface samples were collected from twenty borehole locations at depths of 2, 5, 7.5 and 10 feet bgs and at 5-foot intervals thereafter. All subsurface samples were analyzed for PAHs by U.S. EPA Method 8310. Samples from 2 feet bgs were analyzed for total phenols, total cyanides, and VOCs by U.S. EPA Method 8020. Nineteen background surface soil samples were collected from non-residential open spaces and off-site residential areas. PAHs were detected in 69 of 70 on-site surface samples. The concentration range for *total* PAHs was 0.1 to 176 mg/kg. In the subsurface, PAHs were detected in 46 of the 80 samples collected. The concentration of *total* PAHs was as high as 626 mg/kg. PAHs were also detected in 17 of the 19 background samples. The maximum background concentration of *total* PAHs was 1.0 mg/kg. Data for total phenols and total cyanides are summarized and discussed in a separate section below. Four groundwater samples were collected from three monitoring wells that had been installed to a maximum depth of 25 feet bgs. PAHs were detected in three of four groundwater samples collected. The maximum concentration of *total* PAHs was 33.5 μg/L. Benzene was detected on one sample at a concentration of 2.1 μg/L. Three samples had detectable amounts of diesel range petroleum hydrocarbons (TPH_{diesel}); the maximum concentration was 130 μg/L. None of these three samples had detectable amounts of gasoline-range petroleum hydrocarbons. Data from analysis of air samples collected on- and off-site were unremarkable: the average concentration of airborne *total* PAHs detected eight on-site samples was approximately 25% lower than the concentration detected in four off-site samples.

- **Data Summary Report (URS, January 2001)**. Over a period of four days in June 2000, a total of 426 soil samples were collected from 150 locations around the townhouses, the daycare center and the Midway Village House Office building. At 145 of these locations, samples were collected from the surface (up to 6 inches bgs) and from two feet bgs. Samples were collected from locations throughout the complex (northern and southern portions), including the areas around the Daycare Center and the Midway Village Housing Office. Samples were collected by URS and analyzed by its contract laboratory. In addition, two separate sets of QA/QC samples (duplicates) were collected by U.S. EPA and DTSC. Surface samples were analyzed for individual PAHs (using U.S. EPA Methods 8310 and 8270/SIM), lead and arsenic (using U.S.EPA Method 6010), individual phenolic compounds (using U.S. EPA Method 8270), and total cyanide compounds (using U.S.EPA Method 9010). Samples collected from two feet bgs were analyzed for PAHs only. At five locations in the Cypress Lane area (at the northern end of the complex), samples were collected at four intervals to a maximum depth of five feet. Consistent with regulatory changes that had taken place since the 1993 Remedial Investigation, data for PAHs was expressed as benzo(a)pyrene equivalents [$B(a)P_{eq}$] in order to account for the different carcinogenic potencies of different PAH compounds. In shallow soil, maximum detected $B(a)P_{eq}$ concentration was 16 mg/kg. In samples collected at 2

[2] Note that data from Methods 9010 and 9065 cannot be used for health risk assessment because they represent the summed concentrations of compounds that have common structural characteristics.

feet bgs, the maximum B(a)P_{eq} concentration was 28 mg/kg. The maximum detected concentrations of lead and arsenic were 108 and 6 mg/kg, respectively. Both metals were detected in nearly all samples analyzed. Data for total phenols and total cyanides are summarized and discussed in a separate section below.

- **Data Summary Report Addendum (URS, August 2001).** To confirm selected sample results from the June 2000 investigation, and to address possible data quality concerns expressed by U.S. EPA, an additional round of sampling was conducted in May 2001. A total of 60 samples were collected from 17 locations in the complex. All of these locations were in the vicinity of Cypress Lane, primarily around Buildings 21, 22, 26, 27, 28 and 29. All samples were collected from the upper five feet of soil. Thirteen locations were chosen to validate previous results as they were all within one foot of locations sampled in June 2000. The remaining four locations were all within the backyards of the units in Building 22. All samples were analyzed for PAHs by U.S. EPA Method 8270. However, the report notes that results from the June 2000 sampling event "…indicated strong matrix interference due to the presence of hydrocarbons in many of the samples."[3] Therefore, most of the samples collected in May 2001 were also analyzed by U.S. EPA Method 8270/SIM because this method is "…generally less susceptible to hydrocarbon matrix interference problems." Additionally, all samples analyzed by either method underwent cleanup by gel permeation chromatography prior to analysis. Nine of the 60 samples had B(a)P_{eq} concentrations that exceeded the 0.9 mg/kg screening level. Six of the nine exceedances were found in surface soil samples, and samples from three of the four backyard locations exceeded the screening level. The maximum B(a)P_{eq} concentration was 92.4 mg/kg, detected in a sample collected at 4.5 feet bgs.

- **Removal Action Completion Report (ERRG, 2002)**. As part of the 2001-02 removal action, verification samples were collected from the floor of the excavations at a rate of approximately one sample per 2,500 square feet (i.e., a 50 x 50 foot area). Verification samples were analyzed for PAHs using U.S. EPA Method 8310 with gel permeation chromatography cleanup. Eighty-six excavation floor samples were collected; the maximum B(a)P_{eq} concentration detected was 62.8 mg/kg. Additionally, 16 samples of excavated soil were collected to determine appropriate waste classification (i.e., hazardous or non-hazardous). All sixteen samples were analyzed for metals; five were analyzed for polychlorinated biphenyls (PCBs) by U.S. EPA Method 8082; and fourteen were analyzed for PAHs by U.S. EPA Method 8310. PCBs (as Arochlor 1254) were detected in one sample at a concentration of 47 μg/kg[4]. PAHs were not detected in most samples. The only carcinogenic PAH detected was naphthalene, in two of the fourteen samples analyzed.

[3] Possible matrix interference was noted in a November 28, 200 letter from Bart Simmons, Chief of DTSC's Hazardous Materials Laboratory, to Karen Toth, DTSC Project Manager for Midway Village. A copy of this letter was attached to the January 2001 Data Summary Report prepared by URS.

[4] The U.S. EPA Region 9 Preliminary Remediation Goal for "PCBs (unspeciated mixture, high risk, e.g., Arochlor 1254)" is 220 μg/kg.

- **Indoor Environmental Inspection Report (Indoor Environmental Engineering, 2002)**. In June 2002, indoor air samples were collected at five Midway Village residences, the Midway Village Homeowners Association Office, the Bayshore Childcare Center, and two schools located near the Midway Village complex (Bayshore Elementary and Robertson Intermediate). At most of the indoor sampling locations, an outdoor air sample was also collected for comparison purposes. Samples were collected for a minimum of 24 hours. In each of the five residential units, the gas-fired furnace was operational during the sampling period. An operational furnace produces a "stack effect", creating a relative negative air pressure indoors and drawing in contaminants from outside (including VOCs present in soil beneath the structure). Contaminants were adsorbed onto cartridges containing XAD-s resin and polyurethane foam (PUF). Samples were analyzed for PAHs using U.S. EPA Method TO-13. In general, the maximum indoor concentrations of individual PAHs did not exceed 1 ng/m^3. With one exception, none of the PAHs detected at a concentration greater than 1 ng/m^3 were carcinogenic. The only carcinogenic PAH detected was naphthalene, at a maximum concentration of 151 ng/m^3 (detected in a sample collected at the Midway Village Housing Office). The maximum concentration of naphthalene detected outdoors was 23 ng/m^3. The health risks associated with indoor exposure to naphthalene are addressed separately below.

- In a summary the history of previous site investigations, the *Midway Village/ Bayshore Park Removal Action Completion Report* (Engineering/Remediation Resources Group, 2002) cites two limited studies that were completed by DTSC in the early 1990s. In August 1990, DTSC collected six soil samples from around the daycare center, the baseball diamond at Bayshore Park and a playground in the southern half of the complex. The maximum detected concentration of total PAHs was 1.4 mg/kg. In 1992, seven more samples were collected from around the daycare center and the baseball diamond. The maximum detected concentration of total PAHs was 10 mg/kg. These results are summarized from information in the 2002 ERRG report. OEHHA did not review the original reports of these studies.

In nine investigations carried out over the past 15 years, more than 800 soil samples have been collected at the Midway Village/Bayshore Park complex. The great majority of these samples were collected in the upper two feet of soil, and most of the remaining samples were collected in the upper five feet. Since the entire complex covers approximately 17.6 acres (Ecology and Environment, 1993), the cumulative sampling density is more than 45 samples per acre. Since samples were not collected beneath buildings or paved areas, the sampling density for accessible soil was considerably higher. Furthermore, a biased approach was used to select sampling locations, so the density of sampling was even greater in the northern portion of the complex where higher concentrations of contaminants were known to exist. In our experience few hazardous waste sites, including sites where residential housing and schools have been constructed, have a sampling density as great as this.

Nevertheless, it is clear that the lateral and vertical extent of contamination at the site was not completely characterized. For example, samples collected from the floor and trench

walls of excavated areas indicated the presence of PAHs at concentration well in excess of the target remediation goal [0.9 mg/kg $B(a)P_{eq}$]. Furthermore, the ground beneath the residences was not sampled, and it is a virtual certainty that the PAH concentrations in these locations exceeds the remedial goal. However, since PAHs are not readily mobile in soil and for the most part non-volatile, exposure to these contaminants would not be expected except under highly unusual circumstances (for example, if excavation of soil beneath the foundation were required for a major repair of utility lines). Based on the results of the 2002 indoor air study, potential exposure to volatile PAHs, particularly naphthalene, has been characterized as well. (Health risks associated with inhalation of naphthalene in indoor air are discussed in more detail below.)

There is no disputing that potential "gaps" in characterization of site contaminants have not been investigated as aggressively as they might have been. Several of these potential gaps are discussed below. Nevertheless, based on the high density of surface and sub-surface sampling, the variety of potential contaminants that were analyzed, and the technical sophistication of the analytical methods that were used, OEHHA believes that the environmental samples that have been collected over the past 15 years are sufficient to adequately characterize the potential exposures and consequent health risks to residents living at the complex. We conclude that the site has been adequately characterized for the purpose of making informed risk management decisions.

Comments on Biased Sampling Strategy

In the site investigations that were conducted in the early to mid-1990s, historical information and visual evidence of contamination (discolored soil) provided a basis for biased selection of sample locations. As noted in ATSDR's 1999 Health Consultation, "This biased selection lends itself to a maximum exposure estimate by targeting areas where contamination is likely to be highest." This statement is probably correct if one defines the exposure scenario all residents having an equal chance of contacting soil anywhere in the entire complex. However, in a complex as large as Midway Village, we would regard such a scenario as unlikely. In fact, children and adults are both more likely to contact soil that is in close proximity to their own residence. Therefore, while exposure estimates and consequent health risks to residents in the southern portion of the complex may have been over-estimated, they were very likely to be valid and appropriate for residents living in the northern portion.

Potential Data Gaps: Identification of Chemicals of Potential Concern (COPCs) and Screening Level Risk Estimates

A critical step in conducting a human health risk assessment is the identification of chemicals of potential concern (COPCs). In this process, analytical data for all contaminants detected during the remedial investigation are evaluated to identify those that are related to previous site activities (in this case, MGP operations), and those that are present as a result of non-site related activity. For example, if PAHs had been detected in Midway Village soil at concentrations equivalent to background, one would be justified in concluding that the proximity of the complex to a former manufactured gas

plant did not cause soil to become contaminated with PAHs. In this hypothetical example, PAHs would not be identified as COPCs.

In the 1993 Public Health and Environmental Evaluation (PHEE), COPCs were identified by comparing detected concentrations of individual contaminants in soil with Preliminary Remediation Goals (PRGs), developed by the Region 9 Office of the U.S. EPA. This is not an uncommon practice, but in fact it is an inappropriate use of PRGs because the cumulative effect of concurrent exposure to multiple contaminants is not considered. In addition, eighteen PAH compounds were detected but just thirteen had PRGs, so five were not even evaluated. Nevertheless, a conservative approach was adopted: the maximum detected concentration of each PAH was compared to its PRG, and all 18 PAHs detected in at least one surface soil sample were identified as COPCs. Therefore, the risk estimates in the PHEE are based entirely on the concentrations of PAHs.

Cyanide Compounds

While other compounds and compound classes were detected in site investigations conducted prior to preparation of the PHEE, they were not part of the COPC identification process. For example, phenolic compounds, cyanides and volatile organic compounds were all detected in previous investigations at greater frequencies and higher concentrations than were observed for background samples.

Cyanide compounds are commonly found in soils at former MGP sites (e.g., Shifrin *et al.*, 1996). During the 1992-93 Remedial Investigation, cyanide compounds were detected in 17 of the 70 Midway Village surface soil samples at concentrations ranging from 1 to 41 mg/kg. They were not detected in any of the 17 background samples. Cyanide compounds were also detected in 25 of 184 surface soil samples collected during the June 2000 investigation at a maximum concentration of 9 mg/kg.

In both investigations, samples were analyzed using Method 9010, which measures the *total* cyanide content by converting soluble cyanide salts and many insoluble cyanide complexes to hydrocyanic acid. Since this method does not provide data for individual cyanide species, the data cannot be used in a health risk assessment. In hazardous waste site investigations, analytical methods like 9010 that quantify the aggregate concentration of compounds in a specific chemical class are generally used to identify areas of concern, i.e., areas that warrant additional investigation using more specific analytical methods.

The potential health risks associated with cyanide in soil were evaluated by comparison to PRGs. (See the June 2000 Response to Comments on the Draft Field Sample Plan and the January 2001 Data Summary Report prepared by URS.) As noted earlier, chemical-by-chemical comparison of site-derived data with PRGs is not consistent with standard health risk assessment methodology. Apparently, the maximum aggregate concentration of all the cyanide compounds detected in a single sample was compared to the PRG for "free" cyanide (currently 1,200 mg/kg).

According to Shifrin *et al.* (1996), the most prevalent types of cyanide compounds found at former MGP sites are relatively nontoxic iron-complexed forms such as ferric

ferrocyanide (also known as Prussian blue). For this reason, comparison of the maximum detected total cyanide concentration to the PRG for free cyanide probably constitutes a very conservative, screening-level method for assessing potential health risk. The comparison (the maximum detected concentration of total cyanides was 41 mg/kg *vs*. a PRG of 12,000 mg/kg) suggests that exposure to cyanide compounds in soil will not adversely affect the health of Midway Village residents.

Phenolic Compounds

According to the 1987 GRI report, phenol, 2-methylphenol, 4-methylphenol, and 2,4-dimethylphenol are frequently detected at MGP sites. During the 1992-93 Remedial Investigation, phenolic compounds were detected in approximately half of the 70 surface soil samples collected from Midway Village at concentrations ranging from 0.5 to 31 mg/kg. They were detected in just 3 of 17 background samples, and the maximum background concentration was 0.7 mg/kg. These results reflect analysis for *total* phenols by Method 9065,[5] which does not discriminate between different phenolic compounds. For this reason, analytical data generated during this study are not appropriate for estimating human health risks.

During the June 2000 investigation, 184 surface soil samples were analyzed for individual phenolic compounds using Method 8270C. Phenols were detected in just two of 184 surface soil samples, and the maximum detected concentration was 0.26 mg/kg.

The residential soil PRGs for the four phenolic compounds commonly detected at former MGP sites range 310 mg/kg (4-methylphenol) to 18,000 mg/kg (phenol). As a screening level assessment of potential human health risks, the highest detected concentration of total phenolic compounds detected during the two site investigations can be compared with the lowest PRG of the four phenolic contaminants. This comparison (31 mg/kg detected in a soil samples collected during the 1992-93 investigation vs. a residential soil PRG of 310 mg/kg), together with the very low detection frequency reported in the 2000 investigation, suggests that phenolic compounds in soil are not likely to represent significant health risks at this property. The validity of this conclusion relies in part on the assumption that 4-methylphenol is the most toxic phenolic contaminant in soil.

In summary, it appears that the data for phenolic and cyanide compounds were not evaluated as COPCs in a manner consistent with standard risk assessment methodology, but the conclusion that compounds do not represent a significant risk to the residents appears to be correct.

Volatile Organic Compounds (VOCs)

As noted in the 1987 GRI report, "…the primary volatile organics anticipated at MGP site are benzene, toluene, xylene and ethylbenzene…It should be noted that while these monocyclic aromatics are often present, it is not anticipated that significant

[5] Spectrophotometric analysis by reaction with 4-aminoantipyrine in the presence of potassium ferricyanide at pH 10.

concentrations of their chlorinated or nitrogenated derivatives will be [present] unless operations other than the manufacture of gas occurred on the site."

While low levels of various petroleum-derived and chlorinated VOCs had been detected in early investigations of soil and groundwater, the PHEE did not include an evaluation of VOCs as COPCs. (See also data from Appendix A of the September 1993 Remedial Design Implementation Plan, prepared shortly after the PHEE was released.) While this may be regarded as an oversight, it is not entirely unexpected given the prevalence of relatively high concentrations of PAHs that were present in soil at that time.

The time allotted for OEHHA's review did not allow for a careful review of the limited VOC data. However, it appears that VOCs were detected infrequently and at relatively low concentrations. A retrospective analysis of the data will probably indicate that they did not contribute significantly to overall risk compared to the risks associated with PAHs.

Polychlorinated Biphenyls (PCBs)
The Midway Village/Bayshore complex is immediately adjacent to a PG&E Service Center. Historically, such facilities were used for storage of transformers containing PCBs, and leakage PCB transformer fluid and consequent soil contamination was not an uncommon occurrence. Grading activities occasionally caused the contaminated soil to be spread to adjacent properties. For this reason, investigation of the potential presence of PCBs in soil in the northern portion of the complex would appear to be warranted. Nevertheless, we believe PCBs are not likely to represent a significant human health risk for the following reasons:

- Site History: While the descriptions of site history are unclear in this regard, it appears that the U.S. Navy and the San Mateo Housing Authority maintained control of the property immediately north of the Midway Village complex from 1944 through 1979. In 1979, PG&E reacquired control of this property (Ecology and Environment; July, 1993). The heyday of PCB use began during World War II and lasted through the mid-1970s. PCBs were banned from commerce in 1976 with the passage of the Toxic Substances Control Act (TSCA). Therefore, it appears that PG&E could not have conducted operations on this property when PCBs were most likely to have been involved in those operations.

- Risk Screening Using Available Data: As noted above, 47 μg/kg PCBs as Arochlor 1254 were detected in one of five soil samples analyzed during the 2001-02 removal action. This concentration is well below the U.S. EPA Region 9 Preliminary Remediation Goal for "PCBs (unspeciated mixture, high risk, e.g., Arochlor 1254)" of 220 μg/kg. The PRG was calculated using an exposure scenario that assumes direct exposure to PCBs in soil for 30 years.

- Very Low Frequency of Detection: PCBs are target analytes for U.S. EPA Method 8270. As noted previously, many of the soil samples collected at Midway Village were analyzed for PAHs (Applied Consultants, 1990) and

phenolic compounds (URS, January 2001) using this method. If PCBs had been present in these samples, they would have been detected by this method.[6]

- Effectiveness of Remedial Action: Like PAHs, PCBs are generally immobile in soil and non-volatile. Backfill soil that was used to replace soil excavated during the 2001-02 removal action was analyzed for PCBs and none were detected (ERRG, 2002)[7]. Therefore, even if PCBs were present in unremediated subsurface soil, exposure would be prevented by 2 feet or more of clean fill.

Naphthalene

Naphthalene, a simple two-ring PAH compound, is one of five PAH compounds that is volatile at ambient temperature.[8] Until recently, it was not considered to be carcinogenic. In 2000, however, a National Toxicology Program bioassay of naphthalene in rodents provided clear evidence that the compound was carcinogenic, and in April 2002 it was identified as a carcinogen by the State of California under the Safe Drinking Water and Toxics Enforcement Act (Proposition 65).[9] A unit risk value for naphthalene was established in April 2004.

Because naphthalene is volatile, exposure to this compound may not be completely mitigated by the remedial actions that have been carried out at Midway Village thus far. Volatile contaminants (VOCs) in soil have the capacity to move upward through the soil column to the ground surface. Therefore, if residential housing is situated on VOC-contaminated property, contaminants may enter indoor air via this pathway. Depending on the nature and toxicity of the contaminants, this pathway could represent a significant health risk to occupants of the building.

Although U.S. EPA has developed a computer model for estimating the concentrations of volatile contaminants in indoor air based on the concentration in soil or soil gas[10], a more direct approach to evaluating the significance of this pathway is to determine the indoor air concentration experimentally. This is the approach that DTSC undertook in conducting the indoor air study described above (Indoor Environmental Engineering, 2002). In this study, naphthalene concentrations in the indoor air were determined in two areas of the complex: buildings situated above known sources of contamination (in the northern portion of the complex), and buildings situated in areas where little or no contamination is believed to be present.

In an email message to Karen Toth dated 19 August 2005, Dr. Kimi Klein (DTSC Staff Toxicologist) evaluated the health risks associated with the concentrations of naphthalene that were detected in indoor air at five Midway Village residences. Indoor concentrations of naphthalene detected in three locations over areas of contamination did not appear to

[6] Note that PCBs would not have been detected in samples analyzed using Method 8270 with Selective Ion Monitoring (e.g., URS, August 2001).
[7] Table B-3. The detection limit was 50 $\mu g/m^3$.
[8] The other four "volatile" PAHs – acenaphthene, anthracene, fluorene and pyrene – are not carcinogenic. They are also much less volatile (i.e., have a lower vapor pressure) than naphthalene.
[9] http://www.oehha.ca.gov/prop65/out_of_date/41902notice.html
[10] http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm

be significantly different from concentrations detected in three uncontaminated areas (i.e., 68-116 ng naphthalene/m^3 detected in contaminated areas vs. 62-108 ng/m^3 in uncontaminated areas). Comparing these concentrations with the California Human Health Screening Level (CHHSL)[11] for naphthalene (72 ng/m^3), the cancer risks associated with these concentrations of naphthalene in indoor air were 0.9 to 2.1 x 10^{-6}, assuming a residential exposure scenario. Dr. Klein noted that the method for collecting air samples (adsorption onto XAD resin and polyurethane foam) has an efficiency of approximately 65%. Therefore, the airborne concentrations and the associated cancer risks are 50% greater than the values stated above. These risk estimates are for single chemicals only and do not consider the cumulative risks associated with concurrent exposure to multiple contaminants in indoor air.

The concentrations of PAHs in detected in indoor air were higher than those detected in ambient (outdoor) air. Indoor sources of PAHs include combustion devices such as natural gas-fired forced air heaters and hot water heaters. As noted earlier, the forced-air furnaces inside the residences were operational during the sampling period. An operational furnace produces a "stack effect", creating a relative negative air pressure indoors and drawing in contaminants from outside (including VOCs present in soil beneath the structure). Since the two potential sources for PAH emissions (gas-fired heating devices and contaminated subsurface soil) were not evaluated directly[12], conclusions regarding their relative significance cannot be made based on the available data. Nevertheless, the data from this study provide evidence supporting the conclusion that PAHs in indoor do not represent a significant health risk to Midway Village residents.

Assessment of Potential Human Health Risks

The 1993 Public Health and Environmental Evaluation ("PHEE") and Related Correspondence

An assessment of potential human risks associated with exposure to MGP-derived contaminants in soil was presented in the *Final Public Health and Environmental Evaluation of the Midway-Bayshore Project* (Ecology and Environment, 1993). The procedures used in the PHEE appear to be generally consistent with the standard deterministic approach that was in use at the time it was prepared. While several conservative assumptions were incorporated into the assessment, producing risk estimates that were higher than otherwise would have been calculated, a number of deficiencies were also noted.[13] Furthermore, since the time that the PHEE was prepared, numerous changes in the practice of risk assessment have occurred. Among the more significant of these changes are

[11] http://www.oehha.ca.gov/risk/pdf/screenreport010405.pdf. CHHSLs for carcinogens are based on a cancer risk of 10^{-6}.

[12] For example, measurement of volatile PAHs in soil gas would constitute a direct examination of contaminated soil as a source of emissions to indoor air.

[13] OEHHA did not receive any documents suggesting that the health risk assessment presented in the PHEE was reviewed by a DTSC toxicologist, or that it had a significant impact on subsequent risk management decisions.

- Adoption of Potency Equivalency Factors (PEFs) that account for differences in the potency of carcinogenic PAHs
- Identification of naphthalene as a probable human carcinogen
- Recognition that vapor intrusion of volatile contaminants from soil to indoor air represents a complete exposure pathway, and development of the Johnson and Ettinger model to estimate the magnitude of exposure

Given the deficiencies in the original evaluation and evolution of accepted risk assessment methodology, we believe the 1993 PHEE should be no longer be regarded as a valid appraisal of potential human health risks.

Cancer Risk Associated with the Final Target Remediation Goal for PAHs in Soil [0.9 mg/kg B(a)P_{eq}]

At about the same time the PHEE was being finalized, DTSC received correspondence from Patrick Ritter, project manager from the consulting firm Ecology and Environment, proposing adoption of a 10 ppm cleanup goal for total PAHs. (See letters dated June 11 and June 25, 1993.) Although risk-based calculations were utilized to support this value, the calculations would not be regarded today as consistent with standard risk assessment methods.

The final target remediation goal for the 2001-02 removal action was based primarily on the average background level of PAHs detected in soil from areas surrounding Midway Village. (As a risk management decision, the validity of "cleaning up to background" is discussed below.) The cancer risk associated with the target remediation goal can be estimated using a relatively simple calculation.

The final target cleanup goal for PAHs in surface soil was 0.9 mg/kg B(a)P_{eq}. The U.S. EPA Region 9 Preliminary Remediation Goal (PRG) for B(a)P in residential soil is 6.2 x 10^{-2} mg/kg (0.062 mg/kg), which is equivalent to a residual risk level of 10^{-6} (one in a million)[14]. Therefore, the target cleanup goal of 0.9 mg/kg B(a)P_{eq} equates to a residual cancer risk of 1.5 x 10^{-5}. This level of risk is at the mid-point of the U.S. EPA's target risk range of 10^{-6} to 10^{-4} for hazardous waste sites. The additional risk associated with exposure to naphthalene in indoor air (discussed above) increases the total risk to approximately 1.7 x 10^{-5}.

Comment on Bioavailability of PAHs and VOCs from MGP Sites

Research conducted over the past fifteen years suggests that PAHs in residues from former MGP plants are not bioavailable, that is, they are not readily absorbed following ingestion, inhalation or dermal contact. Recent studies (Hawthorne and Miller, 2003; Stroo et al., 2005; Hong et al., 2003) continue to support this conclusion. PAH bioavailability is a potentially significant issue because human health risk assessments and target remediation goals generally assume100% bioavailability. This is a default assumption in most MGP risk assessments because PAH bioavailability is thought to vary

[14] The exposure pathways included in the PRG calculation are inadvertent ingestion of soil, inhalation of airborne soil particulates, and dermal contact with soil and subsequent transdermal absorption. In areas of Midway Village where surface soil has not been remediated, all of these pathways are complete.

with site-specific conditions. Therefore, the results of PAH bioavailability studies of soil samples collected from one MGP plant are not necessarily applicable to those collected from another.

If the bioavailability of PAHs at Midway Village is less than 100%, then an additional degree of conservatism has been incorporated into the remedial actions taken there. For example, if 50% bioavailability were assumed, then the cancer risk associated with the target remediation level of 0.9 mg/kg $B(a)P_{eq}$ would be approximately 9×10^{-6}.

Assessment of Potential Non-Cancer Health Effects
During the October 25, 2005 meeting of the Cal/EPA Interagency Working Group on Environmental Justice some members expressed concern that the evaluation of potential adverse health effects at Midway village was focused exclusively on cancer, and that possible non-cancer effects (such as skin sensitization) had not been considered. This is a valid concern, as prolonged exposure to PAHs is known to cause a number of harmful effects (ATSDR, 1995 and 2003). OEHHA has identified fifteen PAHs as probable human carcinogens, and all are capable of producing non-cancer toxicity. However, the exposure standards for carcinogenic chemicals are – almost without exception – substantially lower than the standards for exposure to non-carcinogens. For this reason, exposure standards that account for carcinogenicity are more than adequate to prevent the occurrence of adverse non-cancer effects.

Two types of toxicity factors are used in human health risk assessments. One factor is called a c*ancer slope factor* (CSF), and it provides a quantitative measure of the strength (potency) of a chemical to cause cancer. While the process used to derive CSF values is too complex to review in this report, it is important to recognize that it is highly conservative (health-protective). Carcinogens are regulated much more stringently than non-carcinogens. The larger the CSF, the *more* potent a carcinogen is. For example, the CSF values for two PAHs, benzo(a)pyrene and naphthalene, are 12 and 0.12 mg/kg-day^{-1} respectively. This means that benzo(a)pyrene is 100 times more potent a carcinogen than naphthalene.

The other type of toxicity factor provides a quantitative measure of the strength of a chemical to produce toxic (non-cancer) effects. In human health risk assessments, the toxicity factor used to characterize non-cancer toxicity is called a *reference dose* (RfD). A *chronic* RfD is define by the U.S. EPA as

> *…an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime.*

RfDs are generally based on the results of animal toxicity studies that identify daily doses with minimal or no adverse effects on the health of the animals. The minimal- or no-effect level is then divided by a one or more safety factors to account for the possibility that humans may be more sensitive to the chemical or exposed for a longer period of

time. Aggregate safety factors are typically 100-1000, meaning that RfDs are generally 100-1000 times lower than the doses that failed to produce evidence of toxicity in animals. The larger the RfD, the *less* toxic a chemical is. RfDs are used as benchmarks to determine whether exposure a given chemical is likely to cause non-cancer adverse health effects. Daily exposures that are below the RfD are presumed to be non-toxic.

Since carcinogens are regulated more stringently than non-carcinogens, few carcinogens have both a CSF and an RfD. A notable exception is naphthalene, a simple two-ring PAH that was recently classified by the State of California under Proposition 65 as a chemical known to the state to cause cancer based on the results of recent animal cancer bioassays. As a result, OEHHA has developed a CSF for naphthalene. The U.S EPA still regulates naphthalene as a non-carcinogen and continues to use an RfD to evaluate exposure and assess the potential for non-cancer toxicity.

Naphthalene is the only COPC at Midway Village that has both a CSF and an RfD. For this reason it represents a unique example of the additional conservatism introduced when a chemical is identified as a carcinogen. Recognizing that Cal/EPA has identified naphthalene as a carcinogen while U.S. EPA has not, the Region 9 office of U.S. EPA has developed Preliminary Remediation Goals (PRGs) for naphthalene in residential soil under the alternative assumptions that the chemical is either a carcinogen or a non-carcinogen. Assuming that naphthalene is not a carcinogen and utilizing the RfD developed by U.S. EPA, the PRG for residential soil is 56 mg/kg. Assuming that it is carcinogenic and utilizing the CSF developed by OEHHA, the PRG for residential soil is 1.7 mg/kg. Therefore, once naphthalene was identified as a carcinogen, the PRG declined by 97%.[15]

This example illustrates the principle that target remedial goals that are based on the carcinogenic properties of contaminants are generally more than sufficient to prevent the occurrence of non-cancer adverse health effects.

In a June 25, 1993 letter, Patrick Ritter of Ecology and Environment evaluated the potential for non-cancer toxicity (specifically, skin hypersensitivity) using a margin-of-exposure approach. This was a simple comparison of the dermal exposure estimated to result from a given PAH residual level in soil (in this case, 10 ppm total PAHs) with the dose required to elicit a hypersensitivity reaction in animals. The estimated dermal exposure was 700 times less than the lowest no adverse effect level (NOAEL) for skin hypersensitivity reported in the toxicology literature. This approach was not nearly as conservative as the one used in current health risk assessments because a NOAEL from an animal study (rather than an RfD) was used as an estimate of the toxicity threshold in humans. Therefore no safety factors were used to account for the possibility that humans may be more sensitive than animals to PAH-induced skin hypersensitivity. By current risk assessment standards, Mr. Ritter's analysis would not be regarded as a valid appraisal of potential adverse non-cancer health effects.

[15] Until recently, a similar situation existed for arsenic. The residential soil PRG based on non-cancer effects was 22 mg/kg while the PRG based on carcinogenic effects was 0.6 mg/kg. The non-cancer PRG for arsenic was withdrawn in 2004.

Justification for Risk Management Decisions

Overall Strategy
As noted above, the risk management approach was to remove 2-5 feet contaminated soil with B(a)P_{eq} > 0.9 mg/kg and replace it with clean soil. Therefore, clean fill was used to replace existing soil only in those areas where the detected B(a)P_{eq} concentration exceeded 0.9 mg/kg. This strategy ensures that exposure to soil with B(a)P_{eq} concentration in excess of 0.9 mg/kg will not occur, thereby managing potential risks to human health. Post-remediation sampling data clearly show that soil with PAH concentrations in excess of the target cleanup goal has been left in place beneath the excavated and filled areas. In addition, there is little doubt that PAH-contaminated soil is still present beneath the residences even though soil beneath the buildings was never tested. Nevertheless, the opportunity for exposure to PAHs in soil a t levels greater than 0.9 mg/kg B(a)P_{eq} has been largely eliminated, and as a consequence any risks to human health have been eliminated as well.

Opportunities for occasional short-term exposure may still exist. For example, a resident or contractor who is unaware of subsurface soil contamination may for various reasons begin digging in one of the open or landscaped areas of the complex and bring contaminated soil up to the surface. Short-term exposure to a relatively small volume of soil having a PAH content above the 0.9 mg/kg B(a)P_{eq} remediation goal would not be expected to cause adverse non-cancer health effects. Furthermore, institutional controls over excavation activities at Midway Village provide assurance that the duration and magnitude of exposure will be limited.[16]

Adoption of the Background Concentration as a Target Remediation Goal for Carcinogenic PAHs
According to U.S. EPA (1989), "background" concentrations of chemical contaminants are (1) levels present in native soil that are not influenced by human activities (i.e., they are "naturally occurring levels"), or (2) chemicals that are present due to anthropogenic sources *not* related to activities at the site under investigation. Background chemicals can be either localized or ubiquitous. For example, California soils are naturally high in arsenic; levels typically range from 5-10 mg/kg in most parts of the state.

Background residues of PAHs in soil are generated primarily by anthropogenic sources: they result from deposition of airborne particles that are produced by combustion of organic compounds. The burning of petroleum fuel in motor vehicles and combustion of wood in household fireplaces are two primary sources of PAHs in urban areas.

The target remedial goal for surface soil adopted for the 2001-02 removal action was based on a data set of background samples collected for a number of hazardous waste site

[16] A deed restriction on land use at the Midway Village complex was recorded in September 1998. A copy of the original deed restriction is available at http://envirostordev.ecointeractive.com/regulators/deliverable_documents/1977475821/SMBR%5FDEED%5F41650007%2Epdf

investigations. OEHHA did not review the justification for 0.9 mg/kg B(a)P_{eq} as a representative background concentration. However, we were informed that DTSC toxicologists had reviewed the data and supported this conclusion.

As discussed elsewhere in this report, the target remedial goal for PAHs equates to a cancer risk of 1-2 x 10^{-5}. To achieve a 10^{-6} cancer risk, the remedial goal would need to have been one-tenth to one-twentieth the background concentration of carcinogenic PAHs, which would have been inconsistent with U.S. EPA risk management decisions at other sites (discussed below). As stated by U.S. EPA (2004),

> *Generally EPA does not clean up below natural background. In some cases, the predictive risk-based models generate PRG concentrations that lie within or even below typical background concentrations for the same element or compound. If natural background concentrations are higher than the risk-based PRG concentrations, then background concentrations should also be considered in determining whether further evaluation and/or remediation is necessary at a particular site.*

Therefore, establishing a target remediation level that is equivalent to the background concentration of a contaminant is clearly in line with federal risk management guidance.

Conclusions

Based on the reports and other information reviewed, we conclude the following:

- The distribution of PAH contaminants in surface soil at Midway Village and Bayshore Park has been adequately characterized. Over a 15 year period, more than 800 surface and shallow sub-surface samples have been collected and analyzed.
- The lateral and vertical extent of PAH contamination in subsurface soil has not been completely characterized, but potential for exposure to these contaminants has been substantially reduced or eliminated by the remedial actions that have been taken.
- Other classes of contaminants may be present in subsurface soil. However, the available data suggest that these contaminants are either (a) present at concentrations that do not represent a significant human health risk, or (b) not mobile and not present in surface soil, so direct contact exposure pathways are not complete.
- Upward migration of volatile PAHs and subsequent inhalation in indoor air represents a potentially complete exposure pathway. However, the results of the 2002 study indicate that PAHs in indoor air do not represent a significant health risk.
- The cancer risk associated with a target remediation goal of 0.9 mg/kg B(a)P_{eq} is conservatively estimated to be 1-2 x 10^{-5}.
- The target remediation goal is sufficiently low that adverse non-cancer health effects (e.g., skin sensitization) are not expected.

- The risk management decisions and remedial actions taken at Midway Village appear to be consistent with relevant federal risk management guidelines.

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Midway Village Site History
(ERRG, 2002)

2. SITE HISTORY AND CONDITIONS

The Midway Village Housing complex is comprised of 35 multi-family townhouse-type buildings owned and operated by the SMCHA. Nine of these buildings were near to excavation areas (Buildings 22, 23, 24, 28, 29, 32, 33, 34, and 35) as shown on Figure 1-2. The adjacent Bayshore Park is a 3.8-acre park owned and operated by the City of Daly City. The park consists primarily of an open lawn area as well as a baseball field backstop and bleachers, basketball court, and playground area. The following sections describe the history of the Project Site and current site conditions.

2.1. Site Description and Background

Previous investigations of the site indicate that from 1905 to 1916 an oil gas manufacturing plant occupied the western portion of the adjacent PG&E site to the north. Gas produced by the plant was utilized by residences, commercial businesses, and to power electricity generators. During the production of the gas, oil was heated to separate the lighter gas components from heavier components. By-products of the process include residues comprised of tars, powdered carbon and lampblack, which contain PAHs . In 1944, through eminent domain proceedings, the federal government took control of property to the south of the plant and a portion of the property containing the former plant in order to provide military housing. During construction of the military housing the grading operations shifted PAH-contaminated soil into low-lying areas of the proposed housing complex. The housing complex was eventually turned over to the San Mateo County Housing Authority (SMCHA) in 1955. From 1975 to 1977, the SMCHA demolished the original housing complex and constructed new housing to the south (the current location of Midway Village). Daly City received the title to the property that is now Bayshore Park in 1977 and PG&E regained control of the remaining property in 1979.

2.2. Previous Site Investigations

PG&E conducted several environmental investigations in the area adjacent to the former location of the oil gas manufacturing plant, the current location of the Martin Service Center. Results of these investigations, which were conducted in 1982, 1987, and 1988, were submitted to the DTSC and the Regional Water Quality Control Board (RWQCB).

In a 1989 investigation, CH2M Hill collected soil samples from the northwest portion of Bayshore Park (adjacent to Buildings 31 and 32), along the eastern and western fence lines, and from the baseball park infield. The depth of soil samples ranged from surface soil samples to 2-feet bgs. Chemical concentrations ranged from 0.004 to 72 milligrams per kilogram (mg/kg) for total PAHs and less than 0.50 to 2.1 mg/kg for cyanide. No

volatile organic compounds (VOCs) were detected in any of the soil samples collected (Daly City, 1998).

In 1990, the DTSC became involved in the project and collected six additional soil samples in August 1990, from areas adjacent to the Daycare Center, the playground at the south end of the park and in the baseball diamond. Analytical results indicated total PAHs were present at concentrations ranging from 0.21 to 1.4 mg/kg (Daly City, 1998). In 1992, five samples were collected in the vicinity of the Daycare Center and two samples were collected around home plate in the baseball diamond. Concentrations around the Daycare Center ranged from below laboratory detection limits to 10 mg/kg and concentration near home plate were 0.11 mg/kg and 0.04 mg/kg (Daly City, 1998).

In September of 1992, Ecology and Environment, Inc. collected 17 surface soil samples and 33 subsurface soil samples from Bayshore Park and analyzed for PAHs, cyanide, and phenols. Analytical results for the surface samples indicate the presence of total PAHs at concentrations ranging from 0.093 mg/kg to 15.34 mg/kg, cyanide ranging from below laboratory detection limits to 41 mg/kg, and phenols from below laboratory detection limits to 19 mg/kg. Subsurface soil samples, collected from 2 to 10 feet bgs, were found to contain PAHs from below laboratory detection limits to 635 mg/kg, cyanide from below laboratory detection limits to 6 mg/kg, and phenols from below laboratory detection limits to 2.3 mg/kg. Nineteen additional samples were collected from off-site locations as background surface soil samples. Total PAH concentrations ranged from less than 0.2 mg/kg to 1.031 mg/kg, cyanide concentrations were below laboratory detection limits, and phenols were detected at concentrations from below laboratory detection limits to 0.67 mg/kg. Groundwater samples collected during the investigation found concentrations of PAHs at 33.5 microgram per liter (µg/L), benzene at 2.1 µg/L, cyanide at 140 µg/L, ammonia at 2.7 µg/L, and total petroleum hydrocarbons as diesel at 120 µg/L (Daly City, 1998).

Based on these results, a remedial action plan for Midway Village was prepared and approved in 1993 (Ecology and Environment, 1993) and executed in 1994. The remediation involved excavating impacted soil from areas surrounding the residential units and portions of Bayshore Park, then capping the site with two feet of clean soil, concrete patios asphalt, or walkways. The cleanup level for that remediation phase was established as 10 mg/kg of total PAHs (both carcinogenic and non-carcinogenic compounds).

A Removal Action Workplan (RAW) for soil remediation at Bayshore Park was prepared by the City of Daly City in July 1998. The RAW described the site remediation alternatives associated with the installation of a 96-inch diameter storm drainpipe through the Bayshore Park as well as investigation and remediation activities associated with three areas within the park. The remedial action objectives for this project were (1) removal of soil with concentrations in excess of 10 mg/kg of total PAHs and (2) encapsulation of all subsurface soils exceeding 10 mg/kg total PAHs with a minimum of 2 feet of clean material in conjunction with restricting future disturbances through institutional controls.

Lowney Associates performed a soil evaluation study of Bayshore Park for Daly City in December of 1998. The purpose of the study was to determine the concentrations of contaminants in the soil at the park along a proposed stormdrain pipeline alignment and to further define the extent of contamination in the top 2 feet of Bayshore Park. Samples collected included 76 shallow soil samples (0 to 2 feet bgs) and 24 subsurface samples (2-, 4-, 8-, and 12-feet bgs). Total PAHs, reported as B(a)P equivalents, were detected in shallow soil samples at concentrations ranging from below laboratory detection limits to 17 mg/kg. PAHs were also detected in soil samples collected below 2 feet bgs at concentrations up to 11 mg/kg as B(a)P equivalents (Lowney, 1999). The stormdrain pipeline alignment was excavated to accommodate the pipeline installation and the soil was disposed of off-site in accordance with federal, state, and local regulations.

In June 2000, URS Corporation conducted an additional sampling investigation under contract to the DTSC to determine if residual concentrations of PAHs existed in soils at Midway Village. A total of 426 samples were collected from 150 locations in the housing complex and the southern portion of Bayshore Park and analyzed for PAHs, lead, phenols, and cyanide in the soil. Samples were collected at depths ranging from ground surface to 5 feet bgs. Total PAHs, compared to the screening value of 0.62 mg/kg reported as B(a)P equivalents, were detected in shallow soil samples at concentrations ranging from below laboratory detection limits to 16 mg/kg, and in soil samples collected below 2 feet bgs at concentrations ranging from below laboratory detection limits to 28 mg/kg (URS, 2001a). The lead, phenol, and cyanide data were compared to the EPA Region 9 Preliminary Remediation Goals ([PRGs] EPA, 2000) for residential use. The analytical results for these constituents were all below residential PRGs and therefore, were not identified as chemicals of potential concern.

In May 2001, URS Corporation conducted additional soil sampling to confirm selected sample results from the previous investigation that had B(a)P equivalent concentrations above the screening value of 0.62 mg/kg and to address data quality concerns (URS, 2001b). The data were compared to a revised screening level of 0.9 mg/kg for B(a)P as established by DTSC. Sixty primary samples were collected from 17 locations along with six collocated duplicate samples. Of the 60 samples, nine samples from seven separate locations had B(a)P equivalent concentrations above the screening criteria of 0.9 mg/kg. The concentrations ranged from 1.172 mg/kg to 92.39 mg/kg. Six of the nine samples with concentrations exceeding 0.9 mg/kg were found in surface soils to 0.5 feet bgs. Upon the completion of data validation, none of the results were rejected, and all are usable as qualified data.

2.3. Physical Characteristics

The project site is located at the base of the San Bruno foothills approximately 1 mile west of the San Francisco Bay. The site is relatively flat north of Midway Drive where the remediation activities took place, but steepens to slopes of approximately 25 percent south of Midway Drive. The following sections present the topography and soil characteristics of the remediation areas.